NASA Efforts to Apply Lessons Learned from Mars Mishaps

In December 2000, NASA issued a report, *Enhancing Mission Success*, which identified specific actions the agency planned to take to apply prior mishap findings and recommendations broadly in order to improve its approach to executing programs and projects.[4] The development of this report was driven principally by the multiple mission failures associated with the Mars Program. As part of its assessment, NASA reviewed a total of 165 recommendations originating from the Mars mishaps reports, the Shuttle Independent Assessment, and the agency-wide assessment of faster, better, cheaper projects. As a result, NASA recommended 17 actions that are integrated into five broad themes: people, technology, risk management, program and project management, and communications.

One of the 17 recommended actions, which deals with improving communications, concerns knowledge management[5] and the recognition that NASA needs to do better in capturing, disseminating, and utilizing knowledge. This includes improving the capture and application of lessons learned from programs, projects, and missions, with the goal of ensuring that NASA does not have to keep "relearning" the lessons of the past--relearning evidenced by the reoccurrence of similar causes to mission failures or difficulties. The report also indicated a lack of access to and process for lessons learned. The recommended action further stated that the continuous capture and application of project knowledge and lessons learned must become a core business process within the agency's program and project management environment.

Lessons Learning: A Mechanism to Learn from Successes As Well As Mistakes

Use of lessons learned is a principal component of an organizational culture committed to continuous improvement. Lessons learned mechanisms serve to communicate acquired knowledge more effectively and to ensure that beneficial information is factored into planning, work processes, and activities. Lessons learned provide a powerful method of sharing good ideas for improving work processes, facility or equipment design and operation, quality, safety, and cost-effectiveness.

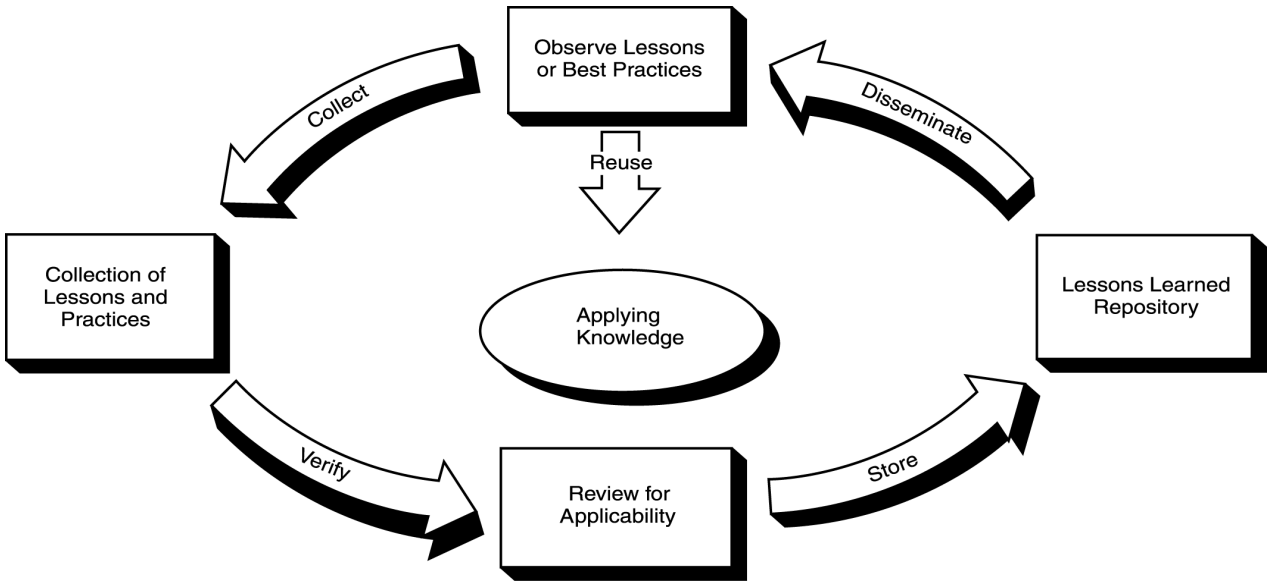
[4] National Aeronautics and Space Administration. *Enhancing Mission Success – A Framework for the Future.* A Report by the NASA Chief Engineer and the NASA Integrated Action Team, December 21, 2000.

[5] Knowledge management can be defined as the way that organizations create, capture, and re-use knowledge to achieve organizational objectives.

Elements of the Lessons Learned Process

The mechanisms or processes used to collect, share, and disseminate lessons learned may vary, but in general such a process is comprised of four main elements: collection, verification, storage, and dissemination. Figure 1 is a generic representation of the lessons learned process.

Figure 1: Generic Lessons Learned Process



Source: Based on Weber, R., Aha, D., and Becerra-Fernanadez, I. Categorizing Intelligent Lessons Learned Systems. *Intelligent Lessons Learned Systems: Papers from the AAAI Workshop* (Technical Report AIC-00-005). Aha, D.W. and Weber, R. (Eds.) pp. 63-67. Washington, DC: Naval Research Laboratory, Navy Center for Applied Research in Artificial Intelligence, 2000.

- The collection process involves the capture of information through structured and unstructured processes such as mishap or accident reporting, project critiques, written forms, and meetings. The collection of lessons may come from as many sources as an organization is willing to solicit. Lessons learned can be based upon positive experiences that prevent accidents or save money or on negative experiences that result in undesirable outcomes. However, if an organization focuses only on failures, its overall program's effectiveness will be reduced and it will miss opportunities to improve all its processes.

- The verification process serves to verify the correctness and applicability of lessons submitted. Domain or subject matter experts may be involved in coordinating and conducting reviews to determine

whether or not a lesson is relevant across many other projects, is unique to a particular department or project, or applies globally to the organization as a whole.

- The storage aspect of lessons learned usually involves incorporating lessons into an electronic database for the dissemination and sharing of information. Information should be stored in a manner that allows users to identify applicable information searches. In addition, each program should include a keyword and functional category search capability to facilitate information retrieval.

- The final element, and the most important, is the dissemination of lessons learned, since lessons are of little benefit unless they are distributed and used by people who will benefit from them. Dissemination can include the revision of a work process, training, and routine distribution via a variety of communication media. Lessons can be "pushed," or automatically delivered to a user, or "pulled" in situations where a user must manually search for them. Lessons can also be disseminated with an assigned priority descriptor, which denotes the risk, immediacy, and urgency of the lessons learned content.